REMARKS/ARGUMENTS

Applicant's invention provides a motor which includes specific structural features for maintaining radial clearances of a ball bearing thereof even as the operating temperature increases.

The Invention

More specifically, as noted by applicant in the description provided at page 2 of the specification, different elements of a bearing device of the motor undergo different radial expansions upon increases in temperature, with the inner diameter of the outer raceway being enlarged more than the outer diameter of the inner raceway, and both tend to increase more than the diameters of the balls therebetween. As a result, radial clearances increase from optimal values and precision, service life and vibration of the device are all adversely impacted.

The effect of such thermal expansion on the bearing of Fig. 2 are described in the paragraph beginning at line 2 of page 9 of the specification for example.

Applicant has provided a novel and unobvious approach to overcoming the above noted problem, by providing *axial* displacement of the outer raceways in order to reduce the *radial* spacing between the inner and outer raceway groove portions in which the balls rotate. Thus, as shown in Fig. 2 for example, when the radial distance D1 increases more than the ball diameter R, the inventive approach increases the axial distance D2. Such an increase axially displaces the outer raceways 14-15 relative to each other (and thus relative to the distance between inner raceways 12-13).

This aspect of the invention is disclosed in the paragraphs beginning at line 14 of page 9, for example.

It will thus be appreciated that, upon displacing the deepest portion of raceway 15 away from the deepest portion of raceway 13 for example, in the manner provided by the present invention, the radial clearance between ball 7b and rings 7a-7b is decreased and the effects of thermal expansion will have been overcome or reduced.

To accomplish such axial displacement, applicant provides a spacer 11 between outer rings 6b and 7b. By providing the spacer with a *larger* coefficient of linear expansion than the outer rings, applicant's invention obtains a desired axial displacement as hereinabove described.

The second embodiment of the invention provides a similar solution of a similar problem arising in bearing devices having a stepped shaft configuration, as illustrated at Figs. 3-4 for example.

While the foregoing provides a novel solution to the problem of expansion of radial clearances by utilization of axial ring displacement, the third and fourth embodiments of the invention adds yet another feature to the inventive structure.

More specifically, in addition to a spacer between the outer rings which has a *larger* coefficient of linear expansion than the outer rings, the third embodiment of Figs. 5-6 and fourth embodiment of Figs. 7-8 adds low expansion rings 22 having a *lower* coefficient of linear expansion than the outer rings, which are press fit around the outer rings.

This embodiment is recited in claims 3, 4, 5 and 6 of the application.

As described at page 12, lines 4-7, for example, when such low expansion rings are press fit around the outer rings, expansion of the outer rings in the radial direction is inhibited, thus suppressing the expansion of the outer ring raceways 14-15 and the resultant damage caused by the previously noted increases in radial clearances.

The Rejection

In the pending Official Action, the Examiner rejects claims 1, 3 and 4 under 35 USC 103 over Chuta US Patent 5,138,209 in view of Torrant US Patent 3,986,754.

Claim 2 stands rejected under 35 USC 103 over applicant's prior patent 5,828,150 in view of Torrant '754 while claims 5-8 are similarly rejected, further in view of Gonser USP 4,966,552.

Traverse

Claims 3-6

It is first noted that, while claims 3, 4, 5 and 6 recite forms of the third and fourth embodiments noted above, and thus specifically include *both* a spacer having a *higher* coefficient of linear expansion than the outer rings *and* low expansion rings having a *lower* coefficient of linear expansion than the outer rings,

However, in rejecting claims 3 and 4 ***the Action fails to address this requirement of the claims***. As a result, the Action asserts only that the prior art

suggests a structure which has a spacer of material having a larger coefficient of linear expansion than the outer rings.

Applicant respectfully submits that, even if, *arguendo*, the Examiner's analysis is taken at face value, none of the art applied to claims 3 and 4 either teaches or suggests, nor has the Examiner addressed, the recited low expansion rings recited in claims 3-4. More specifically, Chuta '209 fails to show any ring surrounding an outer ring, and neither the Chuta nor Torrant reference suggests making such a nonexistent ring of material having a lower coefficient of linear expansion than the outer rings.

Therefore, the action has failed to make a *prima facie* showing of obviousness of the structure recited in claims 3-4 and reconsideration and withdrawal of the rejection of claims 3-4 is clearly in order.

In that regard, it is noted that the present amendment of claim 4 (and its parent claim 2) does not present any new limitation but merely provides clarification of the recitation, by identifying rings as first and second rings to avoid confusion, and by replacing definite articles by indefinite articles. Further, the claim is amended to add the word "in", as found in the corresponding recitation of claim 3. These changes are provided to avoid any assertion of indefiniteness, and clearly do not add any new elements to the claim.

Accordingly, if the Examiner provides any new basis for rejection of claim 4, and clearly any such basis for rejection of claim 3, then such a new rejection can not properly be made in a final action.

Similarly, in rejecting claims 5 and 6, the Action relies on Obara '150 and the previously noted Torrant '754 references. However, it is quite clear that as in Chuta, none of the embodiments illustrated in the '150 reference includes rings press fit on the outer bearing rings.

Accordingly, similarly to the rejection of claims 3-4, the action has failed to make a *prima facie* showing of obviousness of the structure recited in claims 5-6 and reconsideration and withdrawal of the rejection of claims 5-6 is clearly in order.

Therefore, if the Examiner provides any new basis for rejection of claims 5-6, then such a new rejection also can not properly be made in a final action.

Claims 1, 2, 7 and 8

It is respectfully submitted that the Official Action fails to provide any prior art basis for combining the references set forth therein. Therefore, it is courteously submitted that the combination of references relied upon in the Action is motivated and suggested only by applicant's own disclosure.

In other words, the action relies on hindsight reasoning, and on applicant's own teaching, as a basis for rejection of claims 1 and 2.

Nothing in either the Chuta or Obara references teaches a solution to the problems arising from increased radial clearances caused by thermal changes, and particularly by taking the approach taken by applicant in the present invention.

Moreover, while the Examiner asserts at page 2, last paragraph of the Action, that the '754 reference discloses a bearing having a spacer (20) of material larger in its coefficient of linear expansion than of the upper and lower outer rings, applicant respectfully traverses rejection thereover. Applicant courteously submits that the '754 reference merely discloses a spacer which is plastically deformable, However, the Torrant '754 reference fails to provide any suggestion of the advantage of the present invention, specifically that the radial clearance of the bearing device can be retained at an appropriate value, and that the accuracy of rotation can similarly be kept constantly stable, even in the face of temperature variation of the device.

It goes without saying, but is noted for the record, that the unascribed table provided by the Examiner in the pending Action fails to teach or suggest any such approach to solving the problem identified by applicant, in the manner provided by applicant.

Applicant accordingly submits that rejection of claims 1, 2, 7 and 8 is improper and that reconsideration and withdrawal of the same is in order.

New Claims 9-14

In order to help clarify the nature of the invention, new claims 9-14 are provided herein. It will be appreciated that claim 9 derives from claim 1 while claims 12 derives from claim 2. In each instance, however, the newly submitted claims clearly recite a structural element ("clearance maintaining means") for

implementing the specific function of reducing temperature induced variation of radial clearances between elements of the bearing device.

None of the art of record teaches any such structure, or any such function.

Moreover, claim 9 requires that the specific means include a spacer "for axially displacing said outer rings relative to each ball with increasing temperature, thereby to reduce a radial clearance between said balls and said inner and outer rings."

Similarly, claim 12 requires including a spacer "for axially displacing said second outer ring with increasing temperature, thereby to reduce a radial clearance between said balls and said outer ring raceway."

No such structure is disclosed for performing such a function in any of the art of record and, accordingly, it is courteously submitted that claims 9 and 12, as well as the claims depending therefrom, are patentably distinguished from the art of record.

Additionally, claims 10 and 13 identify the advantage and utility of the choice of material for the spacer, as being to "axially displace[s] said outer rings relative to each other with increasing temperature". None of the applied art teaches, discloses or suggests providing such a feature to overcome a problem of increased radial clearance due to increased temperatures.

Finally, claims 11 and 14 once again recite the low expansion rings, made of material having a lower coefficient of expansion than the outer rings, similarly to reduce variation in radial clearances.

As previously noted herein, such a feature (alone, but *a fortiori* in combination with the spacer of higher coefficient of expansion) is neither taught by nor obvious from the art of record.

It is therefore courteously submitted that, on their own merit, newly submitted claims 9-14 are clearly distinguishable over the art of record and that allowance of the same is in order.

In view of the foregoing, it is respectfully submitted that each of the claims pending in the application is in condition for allowance and an early indication of the same is courteously solicited. In order to expedite resolution of any remaining issues and further to expedite passage of the application to issue, the Examiner is respectfully requested to contact the undersigned by telephone at the below listed local telephone number if any further comments, questions or suggestions arise in connection with the application.

Respectfully submitted,

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